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PARENT-CASE:
BACKGROUND OF THE INVENTION This application is a continuation-in-part application of the U.S. application Ser. No. 746,096.

FOREIGN-APPL-PRIORITY-DATA:
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BSPR:
German Auslegeschrift No. 26 31 663 teaches the zero contact measurement of relative changes in length of a sample on the basis of comparative measurements of travel time of laser reflections during continuous scanning of the total measured length of the sample, whereby a light beam is split by a beam splitter, with one portion of the beam of light being directed to the sample and then detected by a photodetector, and the other portion of the beam directed by an adjustable reference **diaphragm** to a second similar photodetector. Repeated scanning of the zone of different reflectivity of the object being measured is required for evaluation in order to obtain any measurement results at all. For this reason, the method does not exhibit sufficient time resolution and, in particular, does not permit immediate

detection of rapid sudden changes in length, so that this method, too, cannot be used for rapid pulling or tearing tests. Moreover, the method allows determination of only an average change in lenght over the total measurement area, and not different stretching behavior in different areas of the sample, especially not the three-dimensional distribution of stretching over the sample, something which is important because a sample is not necessarily subjected to equal changes in length in all of its areas when the same tensile stress is applied, but can exhibit different distributions.

BSPR:
A zero-contact optical measuring method using a cathetometer is described in "Messtechnische Briefe" Vol. 13 No. 2, Page 25-31, 1977 wherein markings made on the samples are scanned with the aid of an optical **aiming device** by the operator and the distances between the markings are measured by a linear measurement system built into the cathetometer. This is a subjective measuring method involving observation, with the adjustments being made by the operator on the basis of the observation possibly being further automatically processed. The subjective decision on the part of the operator is involved in the measuring process. In addition, the known method does not permit any dynamic pulling tests but only creep tests. In addition, only measurements of lengthwise stretching can be conducted.

DEPR:
According to the invention an apparatus is provided which includes a housing 1 accommodating an illuminating device 2 comprising, for example an ellipsoid lamp 3, a **diaphragm** 4, preferably with a volume scattering disk, a lens 6, and an exit **diaphragm** 7. A receiving unit 11 with a shading

diaphragm, a focusing
lens 12, and a photodiode 13 mounted on a holder are
disposed outside of the
housing 1 at a distance therefrom on the optical axis
determined by the
illuminating device 2. The sample under tension 21 is
placed between
illuminating device 2 and receiving unit 11.

DEPR:
In the given arrangement, the cylindrical lens also causes
the light beam to be
guided during the scanning produced by the rotating mirror
so to speak parallel
to itself over the sample under tension beneath the pattern
mounted on it.
Laser beam 33 is reflected from the pulling sample 21.
Accordingly, an
additional receiving device 38 is provided in the housing,
which has among
other things a lens 41 as well as a photodiode 39. The
signals detected by the
two photodiodes 13 and 39 are fed to an electronic circuit
51 where they are
processed in a manner to be described hereinbelow. The
light from lamp 3 is
diffusely scattered by a volume-scattering disk 14 in such
fashion that the
intensity of the light illuminating sample 21 is largely
homogeneous, in other
words every point on the sample is illuminated in the
lengthwise and transverse
directions with essentially the same light intensity in
order to obtain a
signal which is as linear as possible. Double **diaphragm** 4
is associated
directly with scattering disk 14, with the **diaphragm** 4
including two **diaphragm**
slits 16, through which the light from lamp 3 is broken
into two partial bands,
which are rendered parallel by lens 6, whereby the edges of
the light beams can
be blocked out by additional **diaphragm** 7. Accordingly, two
light bands 17
(FIG. 3) fall on sample 21 and the shading **diaphragm** 18
located located
directly behind the sample 21. As can be seen from FIG. 3

in particular, the
amount of light from the two light bands 17 which passes between sample 21 and
shading **diaphragm** 18 is linearly dependent on the width of the sample, which
contracts when the sample is subjected to transverse tension. Calibration can
be done if shading **diaphragm** 18 is adjustable and sample 21 is so adjusted in
the relaxed state that no light falls between shading **diaphragm** 18 and sample
21. The amount of light that passes between sample 21 and shading **diaphragm** 18
during tension is focused by a focusing lens 12 on photodiode 13 and initially
converted into a current which is proportional to the light intensity. The
photodiode is biased in the blocking direction whereby the barrier capacitance
is simultaneously reduced making possible a more rapid response. By connecting
a resistance in series with a photodiode, the photocurrent is converted into a
decreasing proportional voltage through the resistor, whereby the value of the
resistor determines the sensitivity of the arrangement. The additional
electronic circuit initially essentially includes an amplifier and an
electrometer subtractor for zero balancing to exclude ambient light.

DEPR:
The pulling device, not shown in greater detail, comprises clamping devices 23
for firmly clamping the sample 21. The sample 21 (FIG. 5a) comprises a central
part 24 and gripping parts or shoulders 26 which are broadened at both ends
thereof, to which shoulders the clamping devices 23 are attached. In addition,
a transverse pattern 27 with a different absorptivity and therfore reflectivity
or scattering power similar to a **bar code,** is mounted on one side of the sample
21 in middle part 24. A transverse pattern 27 can be printed, for example, by

screen printing. The sample itself consists of any material whose longitudinal stretching in a stretching test is to be investigated, especially in a rapid tearing test. The sample 21 is pulled apart in such a test by a pulling device equipped with clamping devices 23 in the direction of arrrow F. It is evident from a comparision between FIG. 5a and FIG. 5 that the pattern segments increase their spacing as the sample is pulled whereby the frequency of the intensity, modulated by pattern 27, of the reflected light is changed by a beam that uniformly scans the sample, i.e. with constant scanning frequency.

CLPR:
17. An apparatus for measuring a lateral contraction of a test piece having a transverse pattern with a reflectivity differing from the test piece elongated by a drawing device including a device for measuring a lateral contraction of the test piece, the apparatus comprising a light source means arranged upstream of the test piece, said light source means including imaging optic means, a **diaphragm** plate means disposed downstream of the test piece for defining a narrow strip of light from the light source means, and a light detector means positioned downstream of the **diaphragm** and disposed on an optical axis defined by the light source means, the imaging optic means, and the test piece.